The use of genetically modified crops in developing countries

a guide to the Discussion Paper

The Nuffield Council on Bioethics provoked considerable discussion with the publication of its Report, *Genetically modified crops: ethical and social issues* in 1999. Now, four years on, we have decided to produce a follow-up Discussion Paper, focusing specifically on the use of genetically modified (GM) crops in developing countries. The perspective of developing countries is often neglected from discussions in the UK.

We have produced a draft version of the Discussion Paper for comment, and invite views by 8 August 2003. We hope that the paper will contribute to the public debate, 'GM nation?' taking place in the UK during 2003. This summary sets out some of the arguments and recommendations which are discussed in more detail in the draft Discussion Paper. *[Notes in square brackets throughout refer to Sections and paragraphs in the draft Discussion Paper]*

Introduction

In 1999, the Council concluded, on the basis of the evidence available, that there was a moral imperative for making GM crops readily and economically available to people in developing countries who wanted them. We felt it was important to examine whether the arguments for this conclusion are still valid today.

We recognise that we are discussing only part of a much larger picture. There are many factors that contribute to poverty and hunger in developing countries, including war, political instability, lack of infrastructure and poor economic conditions. We do not claim the use of GM crops alone will eliminate the need for economic, political or social change, or that they will simply 'feed the world'. But since agriculture has

such a crucial role to play in developing countries, as a source of employment, income and food for the poorest people, we have considered whether GM crops could help to solve some specific agricultural problems.

In order to assess the role of GM crops in developing countries, we have reviewed the recent scientific evidence, socio-economic trends, and developments in policy, regulation and trade. At the moment, the majority of GM crops are grown in developed countries and address the problems of commercial farmers. However, farmers in developing countries are increasingly beginning to adopt GM crops. Currently, 16 million hectares are being grown in developing countries, by 4.5 million farmers. Most of these are small-scale farmers in China and South Africa, growing GM cotton.

Recent trends in poverty and hunger in developing countries

■ 777 million people in developing countries, including one third of the population of sub-Saharan Africa, are undernourished.

■ Over one billion people, almost all in Asia and Africa, survive on less than US $1 a day. Over 60% of these people depend mainly on agriculture for their living. There are approximately 817 million small-scale subsistence farmers in developing countries.

■ Estimates of population growth suggest that food requirements are likely to rise substantially in the next 20 years.

■ It is predicted that the proportion of the population which is of working age in developing countries will also rise. We suggest that employment will need to increase correspondingly to provide income and economic growth.

■ New varieties of crops introduced in Asia during the 1960s-1980s increased crop yields significantly, allowing agriculture to provide food and work for a growing population, and to cut poverty. However, the improvements in crop yields achieved then have now slowed. Additionally, benefits of the Green Revolution never reached Africa.

Could GM crops make a difference?

We argue that it is necessary to consider new ways to increase agricultural production *[Section 2]*. One possibility would be to expand areas of farmland. However, this is rarely feasible and usually not environmentally friendly and may involve, for example, destroying forests. The only alternative would be for farmers to find ways to increase yields from the same amount of land. Increasing yields of staple crops could provide more food and more employment (and therefore more income to buy food). Even in areas where there is a food surplus, such as India, there is currently undernourishment due to serious poverty.

However, physical conditions for agriculture are worsening. Farmers are faced with problems of increasing water shortages and ever poorer soils. Conventional cross breeding techniques have been slow to address these problems. There are indications that GM technology will provide new approaches and we therefore review the evidence to assess whether GM crops, directed towards specific agricultural problems, could help to increase crop yields.

Possible benefits of GM crops in developing countries

Pest infestations, diseases and poor weather conditions may all significantly lower crop yields in developing countries. GM crops could address these problems, where other breeding techniques have failed. We consider a series of case studies *[Section 3]:*

■ **Insect / pest resistance**
Half the cotton grown in China in 2002 was genetically modified to produce a substance that is poisonous to the cotton bollworm, a pest that devastates many cotton crops. The benefits of this '*Bt* cotton' are a reduction in levels of pesticides used, an increase in yields and an increase in profits and health benefits for farm workers who often apply pesticides without protective clothing.

■ **Disease resistance**
Plants can be genetically modified to be resistant to bacterial, fungal or viral infestation. Examples include sweet potatoes with improved viral resistance and bananas modified to resist the Black Sigatoka fungus. Untreated, this fungus can reduce banana yields by as much as 70% but fungicides are expensive.

■ **Crops that can withstand environmental stresses**
(e.g. drought, heat, frost, acid or salty soil) A gene from a plant which can survive prolonged water stress in desert conditions has been introduced into rice. This allows rice to produce a sugar that protects the plant during dehydration, allowing it to survive periods of drought.

■ **Improved nutritional value**
Crops can be genetically modified to contain additional nutrients that are lacking from the diets of many people in developing countries. One example is Golden Rice, which has been modified to have enhanced levels of ß-carotene, in order to help to prevent vitamin A deficiency. 14 million children under five suffer clinically from this deficiency, which can cause childhood blindness.

■ **Biopharmaceuticals**
Plants could be genetically modified to produce vaccines or other medicines. Potatoes have been modified to produce edible vaccines against the E. *coli* bacteria which causes diarrhoea. This would allow cheap and easy distribution of the vaccine.

Concerns about GM crops

■ Are GM crops safe to eat?

Some people feel that the effects of GM crops on human health are not yet adequately understood. There are concerns about the use of viral DNA during the modification process, and some question whether there would be new health risks if genes introduced in a GM crop were to be taken up by the human body. The safety of GM crops is often assessed by comparison with the closest conventional counterpart. *We concluded that:*

The current evidence from safety assessments of GM crops does not suggest any significant risks to people who eat them. We welcome the fact that concerns about GM have focused attention on issues of safety attaching to new crops and varieties. We recommend that the same standards should be applied to the assessment of risks from GM and from non-GM plants and foods [Section 4, para 122-126].

■ What are the environmental risks of introducing GM crops in developing countries?

There are concerns that the introduction of GM crops might lead to a reduction in biodiversity (the variety of plants and animals in nature), particularly in areas where a crop originated and a wide range of natural genetic variation is found. There might also be unexpected consequences of gene transfer (or 'gene flow') between plants, for example an irreversible or uncontrollable 'escape' of genes into neighbouring wild plants by pollen. Additionally there are concerns that pests or weeds could acquire resistance to crops. *We concluded:*

We believe that the risks of gene flow need to be assessed on a case by case basis. Gene flow occurs widely throughout nature. Whether or not it is acceptable depends primarily on its consequences. The possible risk would depend largely on the particular crop and trait. We are not persuaded that the possibility of gene flow in some areas is sufficient to rule out the planting of GM crops elsewhere in developing countries. It is important to have enough seed banks to conserve genetic resources of crops effectively [Section 4, para 112-121].

■ Are GM crops unnatural?

Many people are concerned that genetic modification is 'unnatural'. Arguments about naturalness are complex, and raise many difficult issues. We discuss these in detail, particularly in relation to similarities and differences between conventional and GM plant breeding techniques. The transfer of genes between species is often thought to be particularly unacceptable because it violates natural species boundaries. *We concluded:*

We take the view that all forms of plant breeding have directly and indirectly changed individual crops or biodiversity in general. Risks and benefits of specific interventions need to be considered in individual cases. We conclude that we do not think that arguments about 'naturalness' are convincing enough to rule out the responsible exploration of the potential of GM [Section 3, para 37-47].

■ Should we be concerned about corporate control?

Five agricultural biotechnology corporations now control most of the technology needed to develop GM crops, as well as the seed and agrochemicals. There are concerns that commercial companies and those who own intellectual property rights have undue influence over the availability of GM crops. Access to this technology is crucial for further research. Additionally, much of GM research currently only serves the interests of large-scale farmers in developed countries, for example focusing on traits such as herbicide tolerance.

We recommend that additional resources should be committed by the UK government and the EC to fund a major expansion of GM-related research relevant to the needs of small-scale farmers in developing countries [Section 6].

The use of GM crops in developing countries

We consider a number of questions that are frequently asked about the introduction of GM crops in developing countries *[Section 4]:*

■ *In view of the amount of food available worldwide, are GM crops really necessary?*
Some people argue that enough food is produced to feed the world's population already, and that more effort should be put into better distribution of food. However, there are several problems with this argument. First, there are considerable logistical and political challenges that hinder redistribution. Secondly, the growing demand for meat, milk and eggs also requires far more staple crops. Additionally, agriculture is a vital part of people's livelihood in developing countries. *We concluded that:*

> *While striving for a fairer distribution of land, food and purchasing power we take the view that it would be unethical to rely entirely on these means to address food insecurity. Given the limits to what redistribution can achieve, there is a duty to explore the possible contributions that GM crops can make. In any event the amount of food available today will not feed the population expansion expected over the next 50 years.*

■ *Why aren't alternative forms of agriculture, such as organic farming, enough to provide crops for people in developing countries to eat and sell?*
Many farmers in developing countries cannot afford artificial fertilisers, insecticides and pesticides, and so practice a form of organic farming. Yields of almost all crops are much lower in developing countries than developed countries, because of problems of poor soil and pest infestations. There are questions whether current 'organic' farming will be able to cope with the challenge of future demands for food. *We concluded:*

> *We take the view that sustainable agriculture can be achieved most effectively when different approaches, including organic and contemporary plant breeding together with GM techniques, are combined appropriately. We think it is rarely either/or, but rather both/and.*

■ *Will GM crops only be of benefit to large-scale farmers? What would their role be in relation to the reduction of poverty?*
Although currently, GM crops mainly benefit large-scale farmers, many small-scale farmers in China and South Africa have already successfully grown GM cotton. In China, yields were estimated to have increased by 10% compared to non-GM crops, and the amount of pesticide used fell by as much as 80%, leading to an increase in profits. It is argued that the efficiency of agriculture has considerable impact on the standard of living of people in most developing countries. It is also important to consider the implications of GM crops for international trade. Exports from developing countries include tea, coffee, cocoa, sugar and cotton. *We concluded:*

> *We believe that, in many instances, GM crops may offer significant improvements to subsistence agriculture. It is also important that exports from developing countries can compete on the world market. If GM crops become more widespread in developed countries, farmers who use non-GM varieties may face financial disadvantages, and the gap between rich and poor could be increased even further.*

◼ Can GM crops be introduced in such a way that local customs and practices are respected?

There are concerns that the introduction of GM crops will destroy traditional agricultural practices. One example is the practice of many farmers in developing countries to save seed between harvests, rather than needing to buy new seed each year. It is suggested that the introduction of GM crops will force farmers to buy seed. *We concluded:*

> *We believe that it is important to ensure that local traditions are respected and to involve farmers in decision making. The use of GM crops need not displace the use of local crops, and the introduction of GM varieties would not stop farmers continuing to save seed from other traditional crops. However, we do believe that there could be a problem if a single company dominated the market. It is important to encourage research, through public sector support, into appropriate seeds (whether GM or not) that can be retained by farmers with minimal loss of yield.*

Risk assessment: the precautionary principle

One way in which people consider the potential risks and benefits of GM crops is by using the *precautionary principle.* This is the rule which permits governments to impose restrictions on otherwise legitimate commercial activities, if there is a perceived risk of damage to the environment or human health, even if not yet scientifically demonstrated.

The precautionary principle can be interpreted in a number of different ways. One common, but controversial interpretation is that GM crops should not be used anywhere unless there is a guarantee that no risk will arise. We conclude that a less restrictive interpretation should be applied. The alternative, of 'doing nothing', also needs to be considered. Introduction of a GM crop may pose fewer risks than exist with the current agricultural system, for example a GM crop could reduce the amount of pesticides used. The risks of 'doing nothing' may often be as great, or greater than the risks of action.

We recommend that in applying the precautionary principle, risks implied by the option of inaction also need to be considered.

Developments in policy, regulation and trade

Decisions about the development, planting and regulation of GM crops take place at many levels, from international regulations down to individual farmers. We outline the system of international governance applying to GM crops and highlight ethical and regulatory issues. We then discuss a number of specific challenges applying to developing countries *[Section 5]:*

■ Level of regulation

Developing countries have to ensure that their policies make sense in the context of their own development needs and also take account of the complex range of international regulations. Should decisions about the planning of GM crops be made at a local, regional or national level? We discuss the advantages and disadvantages of allowing decisions to be taken at a local level.

■ Risk assessments

Undertaking risk assessments, both for health and environmental safety, entails considerable financial and logistical challenges. At present, few developing countries have the capacity for this.

We feel the most appropriate approach would normally be a centralised and evidence-based safety assessment at the national or regional level.

■ The impact of European and international trade policy

International controversies and European scepticism may deter those in developing countries from adopting GM crops. Additionally, EU policy is of considerable significance for developing countries that grow crops for export.

It would be extremely difficult for most developing countries to comply with strict EU requirements for traceability and labelling. Regulations propose that a GM crop must be traced throughout the entire production and distribution process. The threshold for labelling proposed is also very low: any food with more than 0.9% of an approved GM material, or 0.5% of a non-approved GM material, must be labelled. Many developing countries do not have the necessary infrastructure to meet these regulations. There is also concern that even planting GM crops purely for domestic use might jeopardise an export market for non-GM crops. *We concluded that:*

The freedom of choice of farmers in developing countries is likely to be restricted severely by the agricultural policy of the EU. EU regulators have not paid sufficient attention to the impact of EU regulations on agriculture in developing countries.

Food Aid

In 2002 Zambia, Zimbabwe and Mozambique faced dramatic food shortages which threatened more than ten million people with starvation. However, their governments rejected donations of food aid from the US because the maize was genetically modified. Zimbabwe and Mozambique eventually accepted GM food aid that had been milled, but the Zambian government decided to refuse this as well. We explore this controversy, and the reasons behind it.

We recommend that developing countries must be given a genuine choice between GM and non-GM food aid where possible. When developing countries prefer to receive non-GM seeds, the World Food Programme and other food aid organisations should purchase such seed, wherever possible. If only GM donations are available, and the concern is about risks to the environment rather than to health, food aid donations should be provided in milled form [Section 5].

Summary

■ *The use of GM crops, in appropriate circumstances, can have considerable potential for improving agriculture and the livelihood of poor farmers in developing countries.*

■ *There is an ethical obligation to explore the potential of GM crops responsibly. We therefore recommend that research into GM crops be sustained, and directed towards the needs of small-scale farmers in developing countries.*

■ *The possible costs, benefits and risks associated with particular GM crops can only be assessed on a case by case basis. It is important to ask the question: how does the use of a GM crop compare to other alternatives?*

Copies of the draft Discussion Paper are available to download from the Council's website: www.nuffieldbioethics.org

For a printed copy, please e-mail bioethics@nuffieldfoundation.org